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IMPRINT Analysis of an Unmanned Air System Geospatial Information Process

by Bruce P. Hunn, Kristin M. Schweitzer, John A. Cahir, and Mary M. Finch

ARL-TR-4513 **July 2008**

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14. ABSTRACT

This study evaluated the streaming video analysis portion of the geospatial intelligence process associated with an unmanned aircraft system, which provides information to a four-person, military intelligence, geospatial analysis cell. The Improved Performance Research Integration Tool (IMPRINT) modeling program was used to understand this process and to assess crew workload during several test scenarios. Based on the use of IMPRINT, recommendations are made regarding the level of staffing for this type of system, based on crew workload characteristics discovered. This initial model was the first segment of a more comprehensive model to be developed to look at full mission conditions for a 12-hour shift.

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ERMP, geospatial, IMPRINT, manpower, workload

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1. Introduction

"Geospatial intelligence (GEOINT) is intelligence derived from the exploitation and analysis of imagery with geospatial information to describe, access, and visually depict physical features and geographically referenced activities in the operational environment. GEOINT consists of imagery, imagery intelligence (IMINT) and geospatial information" (Department of the Army, draft).

A technical definition of geospatial information consists of, "geodetic,* geomagnetic, imagery, gravimetric,† aeronautical, topographic, hydrographic, littoral,‡ cultural, and toponymic§ data that are accurately referenced to a precise location on the surface of the earth" (Kabinier, 2001). Note: all definitions were taken from http://dictionary.reference.com on 23 and 24 January 2008.

For the purposes of this report, the focus is on creating a model of the military intelligence (MI) image analyst, when s/he is tasked with using geospatial imagery information as provided by an extended range multipurpose (ERMP) type of unmanned aircraft system (UAS). The role of this imagery analyst is to create a product that MI organizations can present to commanders in order that they may better understand the implications that GEOINT has on the battlefield. In short, MI transforms geospatial information into data with context and meaning: intelligence. Overall, this process draws from sources such as governmental or non-governmental agencies, UAS, or Soldiers in the field to create a product that may contain a written report, presentation, imagery, or all these things combined. On the whole, GEOINT is the combination of the engineer-based geospatial information and the MI-based intelligence products, but that modeling effort is planned to follow this preliminary report on one element of that complex task.

2. Background

Geospatial information is normally gathered through ground-based means such as surveys and through remote means such as aircraft or satellite images. Technical enhancements have enabled greater accuracy with lower variability and provided a much larger perspective of the world than has ever been available before. UASs provide multiple image feeds (e.g., electro-optical, infrared), each providing a valuable and unique perspective but each requiring analysis in order

* Of or relating to or determined by geodesy, which is the scientific study of the size and shape of the earth, its field of gravity, and such varying phenomena as the motion of the magnetic poles and the tides.

† Of or relating to measurement by weight or variations in a gravitational field.

‡ Of or pertaining to the shore of a lake, sea, or ocean; the region or zone between the limits of high and low tides.

§ Of or pertaining to a name derived from a place or region.

to create an intelligence product. Manned aircraft and satellites capture images and information with great precision but also require analysis in order to provide useful intelligence.

However, the continuous and rapid evolution of technology is creating an increasing gap between equipment output and the military's ability to provide sufficient analytical capability, including appropriate personnel and training. Personnel and training shortfalls in the geospatial and GEOINT areas are currently being addressed through a restructuring of several MI military occupational specialties (MOSs) to ensure that personnel obtain enough knowledge and familiarization with the critical tasks to successfully perform their job. However, it is critical that the proposed staffing and training levels match the workload level that new technology will impose. The manpower-requirement issue for geospatial analysis requires consideration of the number of video feeds, size and complexity of the area of interest, detail required by commanders, operational tempo, and a slew of other variables that are a function of the situation.

2.1 Challenges

Information gathering and the intelligence-analysis process function hand in hand but require distinct skill sets. Separate from information gathering, the intelligence, analysis process has little to do with staffing equipment in the traditional sense. It has everything to do with recognizing items of interest, establishing connections, knowing where best to look for useful information, and communicating the results in a format that is understandable to a highly diverse audience with respect to background and experience. How long does it take to find a useful image or to identify a feature near a building? It depends upon what is being sought, the neighborhood of the building, or the quality of the image. How many tasks can an analyst perform at the same time and for how long until she/he begins to miss pieces of important information? It depends upon the person’s cognitive ability, physical environment (including the system displays), and training. To return to the initial question, how does one determine manpower requirements for a cognitively intense job?

One way to determine manpower requirements is to set up a high-fidelity mock mission and experiment with how people with various experience, training, and cognitive abilities perform different tasks. While perhaps the more traditional way to determine manpower, it is expensive, time consuming, and resource and personnel intensive and may be limited by participant availability, the numbers and kinds of missions and conditions that can be run, etc. An alternative is to model the process.

2.2 Purpose

This report addresses the results from an improved performance research integration tool (IMPRINT) analysis of the manpower requirements for a narrowly defined GEOINT scenario. The scenario uses an ERMP type UAS in a task force (TF) observe, detect, identify, neutralize (ODIN) mission to illustrate the tasks of integrating geospatial information from the UAS streaming video portion of the GEOINT mission. To accomplish this analysis, the IMPRINT

program was used to assess the image analyst's workload levels for several scenarios. The IMPRINT program uses stochastic task-network modeling to predict human cognitive workload (IMPRINT, 2007). It can easily analyze alternate crew-system function-task allocation schemes and run repeated missions in order to examine variations in task performance, accuracy, and multitasking.

The objective of this analysis and report are to establish staffing levels congruent with the image analyst's tasking, while assuring that whatever those staffing levels are, the crew of this image analysis cell is not overloaded or underloaded in their work. The proper level of workload for individual team members as well as the team overall is where neither any individual nor the team is subject to extreme levels of overload nor extreme underload but can operate at a fully engaged, productive, moderate workload level. IMPRINT modeling can assess the workload of individuals as well as the team and project a proper balance, based on the input of subject matter experts (SMEs), as well as operators experienced in image-analysis positions. The proper level of staffing is critical for the effective performance of the cognitive type tasks that image analysts perform, and IMPRINT was created to evaluate this type of work scenario. The goal of this study would be to make staffing recommendations for imagery analysts, which best suit the goal of accomplishing the GEOINT type of mission for a single, continual-feed UAS, independent of echelon and platform.

2.3 Impact

Modeling the imagery-analysis process is a cost-efficient way to estimate the manpower requirements to perform a cognitively intensive mission. The results of the IMPRINT assessment will allow commanders to see where their people will potentially have trouble performing their assigned tasks and, as a result of that trouble, what types of information might be neglected.

3. Method

Tasking guidance was to model personnel from MOS 35G (Imagery Analyst,* formerly MOS 96D). The critical task list for 35Gs (in use in July 2007) was obtained from the 305th MI Battalion and refined to list only the tasks relevant to a TF-ODIN scenario. The critical tasks were entered into IMPRINT as *functions*, and the performance measures of those critical tasks were entered as *tasks*.

* The Imagery Analyst is an enlisted Soldier who is primarily responsible for supervising and analyzing aerial and ground permanent record imagery developed by photographic and electronic means (http://www.goarmy.com/JobDetail.do?id=153, 23 Jan 2008).

Since the tasked mission of deriving geospatial information from ERMP* feeds is currently nonexistent, initial staffing numbers could not be based on existing teams. The initial model depicted four crew members at the suggestion of SMEs and instructors with the MI 35G Basic and Advanced Non-Commissioned Officers' Courses (BNOC, ANOC) at Fort Huachuca, Arizona. The suggestion was based on real-world TF-ODIN missions in Iraq and Macedonia that were conducted with aerial vehicles other than ERMP. The first crew member's task was imagery exploitation (level 1 only): to monitor the ERMP video feeds, take screen captures of items that required further investigation, and transfer them to the second crew member. The second crew member's task was to investigate the captures that the first crew member collected, research and collect relevant information from other sources such as the National Geospatial-Intelligence Agency (NGA), and transfer the annotated information to the third crew member. The third crew member's task was to write reports, develop presentations, or prepare other imagery products that might be required for submission to the commander. The fourth crew member's task was to supervise the first three crew members, substitute when needed, and review the products before they were delivered to command, as well as coordinate for Multi-Int information, and all source intelligence support, in addition to participating in required briefings or meetings. Most of the work was done in parallel since background mission information and general annotations could be done without specific video captures from the first crew member. However, specifics that were unique to each capture were done serially.

3.1 Participants

After the basic crew member tasks were determined, the authors developed a questionnaire (see appendix A for the questionnaire instructions and excerpts) that was given to instructors of the 35G BNOC and the 35G ANOC and to students of the 35G BNOC and of the 350G (Imagery Intelligence Technician,† formerly MOS 350D) BNOC. All instructors were previous graduates of 35G ANOC.

The instructors and students who completed questionnaires ranged in rank from E6 to E7 and CW1 to CW4. All Soldiers had at least one year of experience as an imagery analyst, and most had 35G or 350G experience from multiple deployments in theater. Soldiers' experience ranged from the brigade level to the national level. The questionnaire asked for average expected times, accuracy, and visual, auditory, cognitive, and psychomotor (VACP) workloads for the tasks required in an analyst's duties; 41 questionnaires were completed with task time data; 20 of the 41 questionnaires included VACP data.

* ERMP is a multimission aircraft based on the Predator that will provide the U.S. Army with a long-endurance, persistent ISR (intelligence, surveillance, and reconnaissance) and tactical strike capability featuring a heavy-fuel engine for increased supportability in the field (http://www.ga-asi.com/products/er-mp-uas.php, 24 Jan 2008).

† The Imagery Intelligence Technician is a warrant officer who provides technical expertise and manages activities engaged in imagery analysis (http://www.usarec.army.mil/hq/warrant/prerequ/WO350G.html, 23 Jan 2008).

3.2 Workload

Overall workload (O_w) in IMPRINT was defined as $O_w = V + A + C + P$. Overload occurred when total visual workload was greater than 7 ($V > 7$), when total auditory workload was greater than 7 ($A > 7$), when total cognitive workload was greater than 7 ($C > 7$), or when overall workload was greater than 40 ($O_w > 40$) for any one crew member. While the addition of the four VACP domains numerically equals a workload level of 28, a modeling precedent from studies has developed the numeric value of 40 as a more representative value than simply adding the domain qualities serially. The values used to define overload are supported by limited research and precedent (Pomranky and Wojciechowski, 2007; Mitchell et al., 2003; Mitchell, 2005). It is expected that a crew member with a workload of 30 is fully engaged.

This approach of setting 40 as a workload overload point makes allowance for human variability of performance at high workload levels and the possibility of some parallel processing of the VACP values, even at high workload levels. This distribution of effort across domains is both intuitive and commonly recognized in cognitive tasking of all types (e.g., talking on the telephone while watching a TV screen) and recognizes that both actions may be accomplished at the same time, with some individual performance decrement for each task being present but the overall tasking being performed at a reasonable level of accuracy. It is very important to consider that the VACP scale as well as IMPRINT results are relative measures rather than absolute values and that relative comparisons are the purpose of the modeling effort and not establishing absolute workload levels. For example, the workload rating values are not ratio scale (i.e., engineering quality) data but are subjective and more useful for comparing one scenario with another or one crew member's effort with another's on a common scale metric. The IMPRINT output is therefore useful for determining order of magnitude types of effects rather than fine nuances in workload levels.

3.3 Scenario

The scenario was a 12-hr TF-ODIN scenario based on actual missions and operated only from the division level and below. The model was built with 2+-hr segments for each of the four crew members. This report details only the first 2+-hr segment of the mission since the modeling and analysis of the entire 12 hr are ongoing. See appendix B for the detailed scenario.

3.4 Assumptions

Certain assumptions were made to limit the number of variables and to focus the initial model. Those made for the model described in this report are as follows:

- ERMP feed is from a single platform and 274 mbps of electro-optical/infrared (EO/IR), synthetic aperture radar (SAR), and moving target indicator (MTI). The analysts receive direct (live) feed from ERMP 24 hr per day, 7 days per week.

- The pilot and the payload operator for the ERMP are not co-located with the analysts. The analysts will communicate with and direct the ERMP pilot and payload operator via voice through various communication channels.
- Imagery analysis is required "on demand" and is performed by a 35G. Only level 1 exploitation is performed. (Level 1 analysis consists of generic classification of military objects, e.g., truck vs. car vs. tank, as opposed to Dodge vs. Volkswagen vs. M-1A.)
- Weather, equipment failure, and communications loss will not be a factor in this model. Equipment is capable of meeting all data storage requirements.
- No automated fusion of imagery products occurs.
- Injury, illness, absence from station, rotations, prolonged duration of duty, or personnel substitutions are not factored into this model.

4. Results

Total time for the first segment of the 12-hr model averaged 2 hr 45 min across 20 iterations. The variable of interest was workload, so time and accuracy data are only referenced when they clarify a point. The data excerpts are in appendix C.

4.1 Crew Member 1: Primary Imagery Analyst

The Primary Imagery Analyst's duty was to monitor direct imagery feeds from ERMP and capture relevant snapshots of imagery and video for further analysis. Tasks included maintaining voice contact with the ERMP pilot and payload operator, directing the ERMP sensor employment, plotting coordinates on images and maps, and identifying objects or events in the imagery.

The number of concurrently performed tasks ranged from none to four, with overall workload reaching overload when three or four tasks were required at the same time. Figure 1 illustrates the Primary Imagery Analyst's workload and number of concurrent tasks for the first 2+-hr segment of the TF-ODIN mission. The Primary Imagery Analyst's overall workload exceeded 40 8% of the time in three distinct workload spikes. The first occurred at the start of the mission (Mission Time = 00:00:00 [hh:mm:ss]) and lasted about 2 min while the Primary Imagery Analyst was maintaining voice contact with the ERMP operators, exploiting full-motion (video) imagery, and conducting aerial route reconnaissance, all at the same time.

The second overload in overall workload lasted about 6.5 min and consisted of two related spikes with a brief (~2-min) respite between them. During both spikes and the respite, the Primary Imagery Analyst was concurrently exploiting full-motion imagery and conducting aerial route reconnaissance. These two tasks by themselves did not cause overload, as demonstrated by the

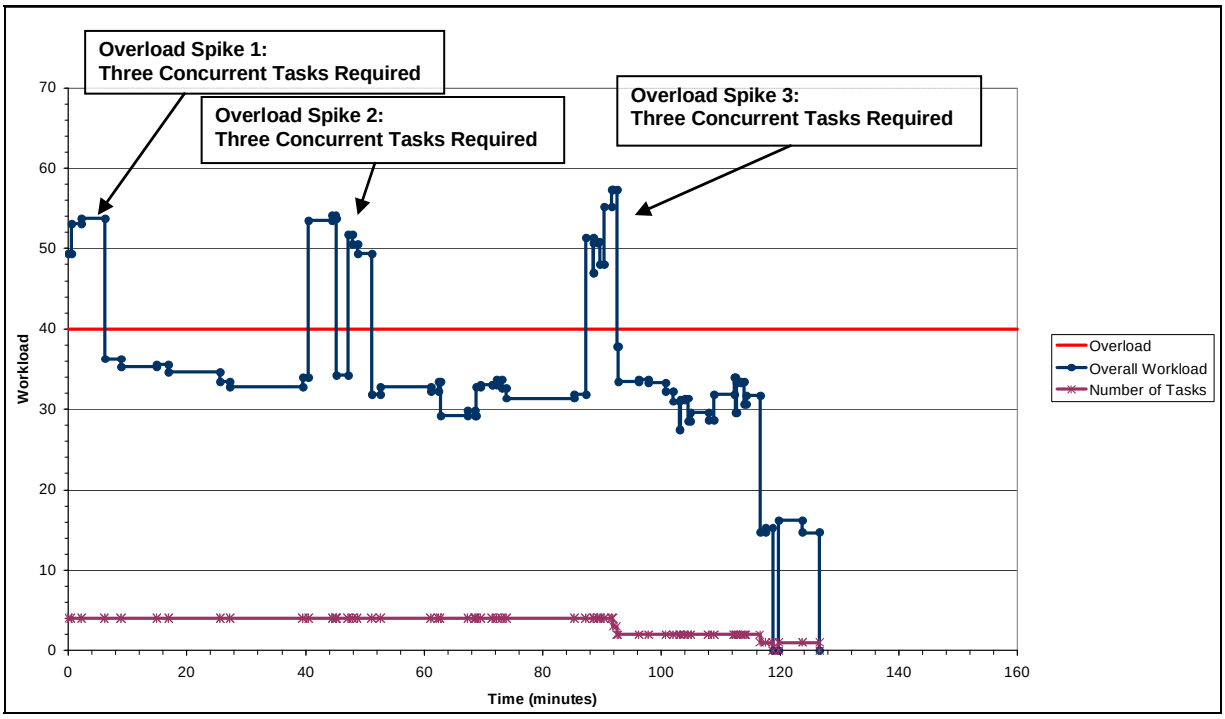

Figure 1. Primary Imagery Analyst workload.

respite. However, the additional task of directing the ERMP sensor employment induced overload for the first spike, and the addition of maintaining voice contact with the ERMP operators induced overload for the second spike.

The third incident of overload occurred ~90 min into the mission and lasted about 4.5 min. Three combinations of tasks caused the overload, all of which included concurrently exploiting full-motion imagery and directing the ERMP sensor employment. The third concurrent task for each combination was identifying roadways on imagery, plotting coordinates on an image or map, and identifying unconventional acts on the imagery, respectively.

4.2 Crew Member 2: Production Analyst

The Production Analyst 1's duty was the level 1 exploitation of imagery captures received from the Primary Imagery Analyst and to retrieve relevant information from other sources. Tasks included exploiting full-motion imagery, retrieving information from databases and other sources (governmental and nongovernmental), preparing imagery-derived products, and analyzing activities in support of various missions.

The number of concurrently performed tasks ranged from none to four, with overall overload occurring when three or four tasks were required at the same time. Figure 2 illustrates the Production Analyst 1's workload and number of concurrent tasks for the first 2+-hr segment of the TF-ODIN mission. The Production Analyst 1's overall workload exceeded 40 ~55% of the time. At all times during the overload condition, the Production Analyst 1 was performing at

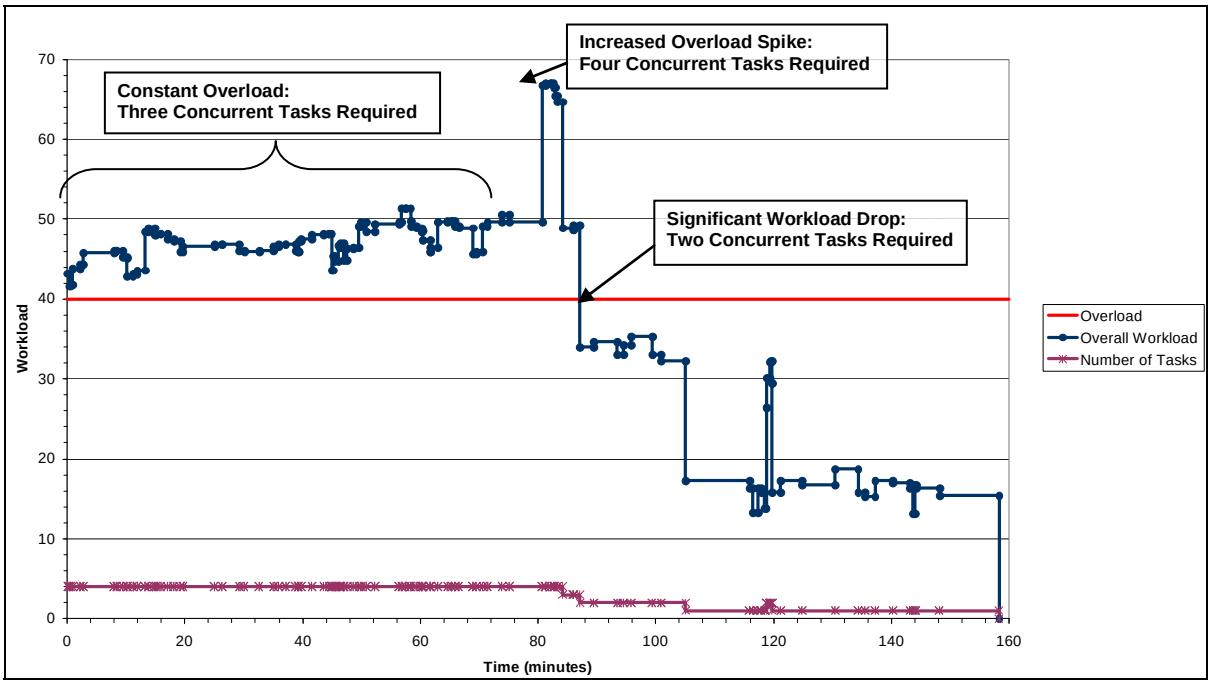

Figure 2. Production Analyst 1 workload.

least three of the following tasks concurrently: retrieving information from other sources, analyzing activity in support of mission, preparing imagery derived products, managing electronic maps, managing data files, identifying vehicle types on imagery, determining geospatial position data from imagery, determining the dimensions of an object on imagery, identifying man-made obstacles on imagery, and exploiting full-motion imagery. The workload spiked about 80 min into the mission when four tasks required the Production Analyst 1's attention at the same time: analyzing activity in support of mission, identifying man-made obstacles on imagery, exploiting full-motion imagery, and preparing imagery-derived products. The spike ended with the completion of the fourth task, leaving the Production Analyst 1 performing three concurrent tasks. Workload fell below 40 near 90 min into the mission after the third task was dropped, and only two tasks were required concurrently.

4.3 Crew Member 3: Production Analyst 2

The Production Analyst 2's duty was to prepare products and reports for delivery to command. Tasks included responding to intelligence taskings, preparing overlays, translating information into military symbols, manipulating computer files, and managing electronic maps and data files.

The number of concurrently performed tasks ranged from none to three, with overall overload occurring when two or three tasks were required at the same time. Figure 3 illustrates Production Analyst 2's workload and number of concurrent tasks for the first 2+-hr segment of the TF-ODIN mission. Production Analyst 2's overall workload exceeded 40 nearly 14% of the

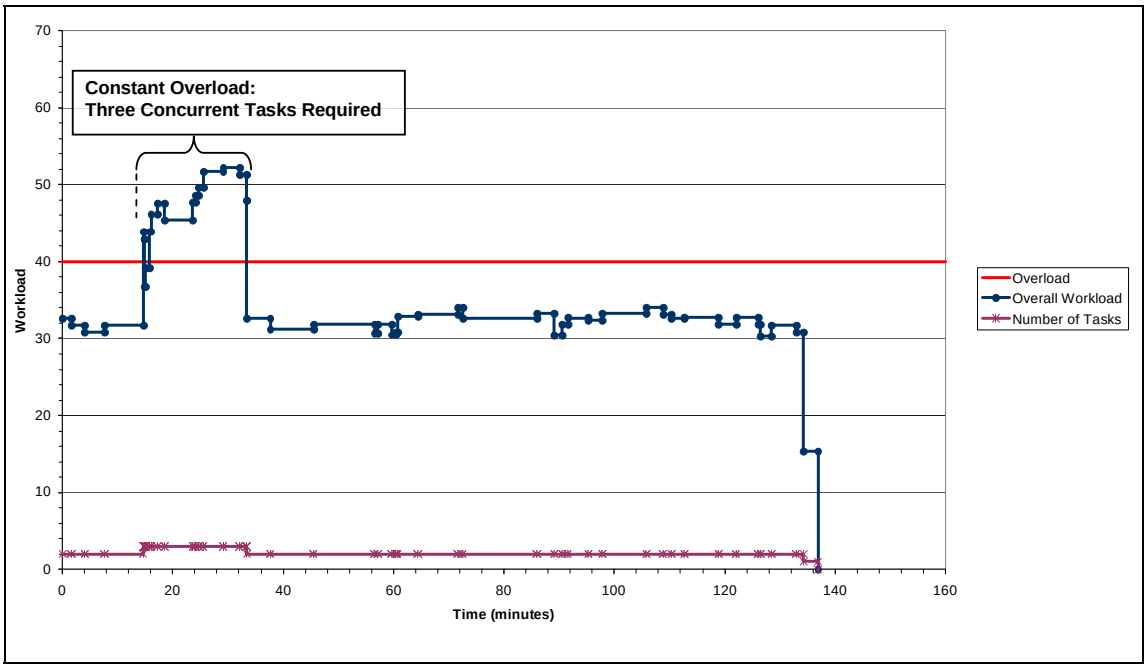

Figure 3. Production Analyst 2 workload.

time. During overload, Production Analyst 2 was performing three of the following tasks in varying combinations concurrently: retrieving information from other sources, preparing situation overlays, managing data files, and manipulating computer files.

4.4 Crew Member 4: Non-Commissioned Officer in Charge (NCOIC)

The NCOIC's duty was to respond to intelligence taskings, manage shift operations, advise command, and provide quality control on imagery-derived products derived by the team. The number of concurrently performed tasks ranged from none to four, with overall overload occurring when three or four tasks were required at the same time. Figure 4 illustrates the NCOIC's workload and number of concurrent tasks for the first 2+-hr segment of the TF-ODIN mission. The NCOIC was overloaded 37% of the time. During the overloaded period, three to four of the following tasks were performed concurrently: manage shift operations, select appropriate sensors, analyze activity in support of the mission, determine the available GEOINT products, request information, retrieve information from other sources, respond to intelligence taskings, advise command, and perform quality control on products.

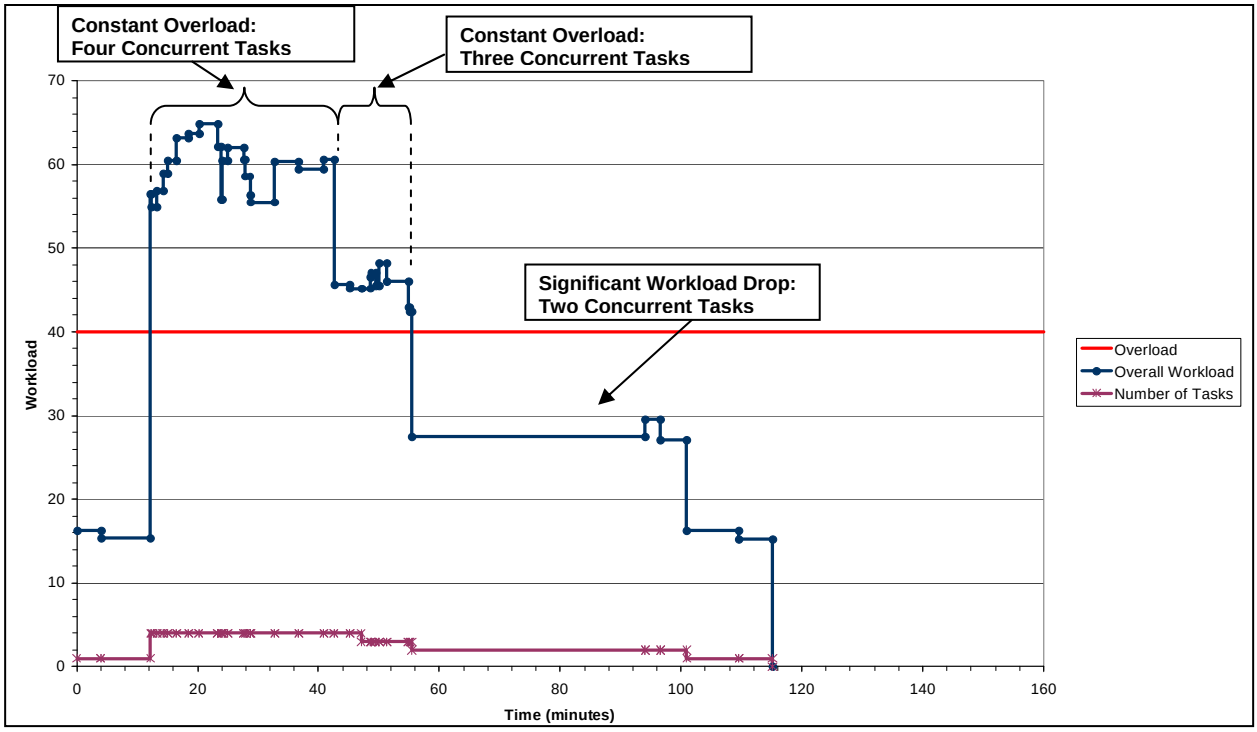

Figure 4. NCOIC workload.

5. Discussion

Given the nature of the tasks involved with a 35G Imagery Analyst's duty, the model indicates that as a general rule, no more than two tasks may be performed concurrently to maintain an acceptable overall workload level. For many of the 35G's tasks, to maintain VACP workloads within acceptable levels generally requires only one task be performed at a time.

The number of tasks indicated on the graphs can be somewhat deceiving. Within the model, breaks and lulls with no workload were added as spacers to enable the appropriate tasks to begin at the times required by the scenario. IMPRINT counted these breaks and lulls as tasks. For example, of four tasks only three may have workload values, meaning only three tasks are contributing to the overall workload. One should use caution in taking the number of tasks on the graph at face value.

Overall workload, especially for the NCOIC, drops at predictable points, i.e., when one of the workload-intensive tasks ends (see figure 5). After the full 12-hr shift model is completed and the task integration is refined, no significant drop in overall or VACP channel workload is expected near the 2-hr mark.

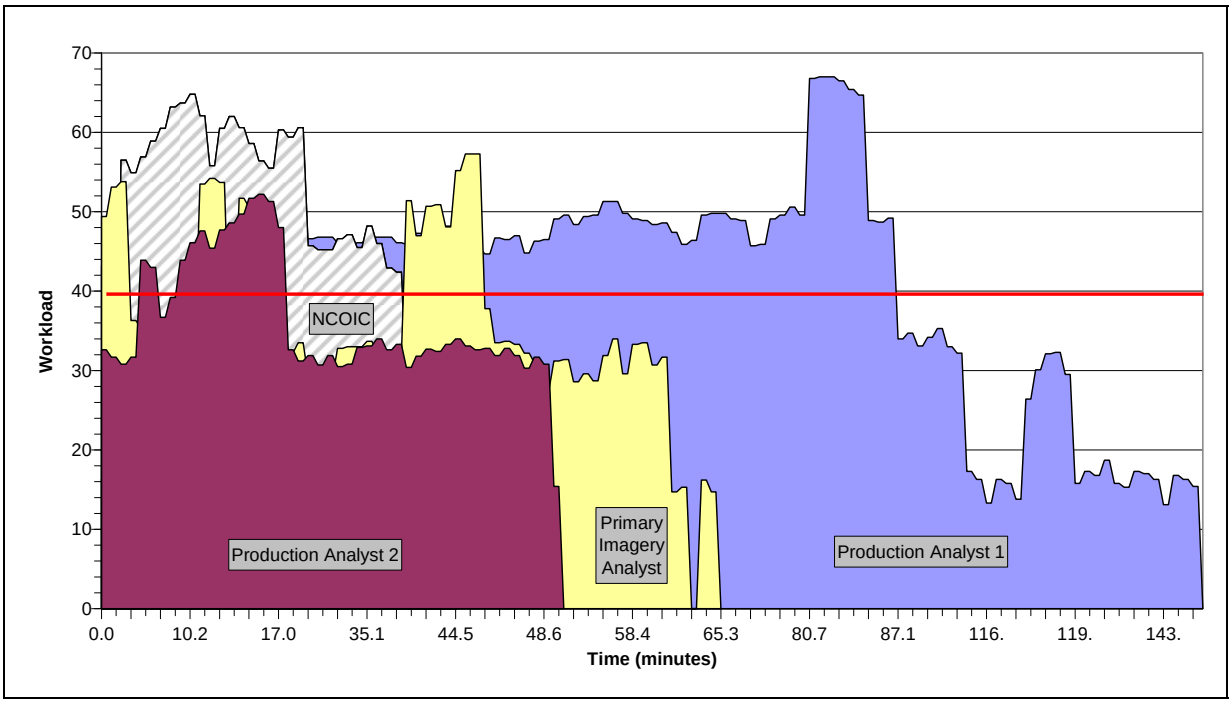

Figure 5. Overall workload for all four crew members.

6. Conclusions and Recommendations

The model of the 2+-hr mission segment indicates that all four imagery analysts will experience overload with their overall workload at some point during the first part of their mission. While any values over 40 are considered overload for this model, the consistent values near 32 indicate significant workload on all four team members for large portions of the mission segment. Spikes in overall workload clearly show where multiple tasks are required of the analyst at the same time.

The authors recommend continuation of the current model to account for the remaining 10 hr of the analysts' shift. To this point, the model indicates that analysts will have a challenging time completing the required tasks well because of multitasking and mental processing capacity.

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Appendix A. 96D Questionnaire Explanation

You are being asked to fill out a lengthy questionnaire in order to assist us in answering a question asked by the HQ Department of the Army to MI, "How many 96D analysts are required to support the Extended Range Multi-Purpose (ERMP) UAV."

The purpose of this questionnaire is to provide data (times, accuracy, etc) for a human performance model which will provide information on how many 96Ds are required to perform imagery analysis of the data/information expected from ERMP.

This questionnaire asks for a great deal of detail, which is required by the type of model (the IMPRINT model) being used to determine 96D requirements for the Army.
The Improved Performance Research Integration Tool (IMPRINT) is a model developed by the Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED). IMPRINT is consists of a set of automated aids used to assist analysts in conducting human performance analyses. IMPRINT provides the means for estimating manpower, personnel, and training requirements for new systems (In this case ERMP) or processes.
We are trying to:

- Project future manpower levels and personnel characteristics through a task-based analysis of critical tasks
- Predict the effects of environmental stressors and sustainment training frequency on performance
- Estimate individual and collective section workload

Although some of the questions may appear to be "repeats" of previous questions and are highlighted in gray. You do not have to answer them again unless you believe that under this function your answer would be different than you previously gave under another function.

If you have served in a number of 96D positions doing these tasks, select one of your experiences to draw from to answer the questionnaire. List that echelon where you worked at the beginning of the questionnaire.

In **BOLD** typeface are the overall functions, and below these functions there will be several separate tasks an analyst must perform to complete each overall function. Fill in the values for each separate task as explained below.
TIME: Please use seconds, minutes, etc. to estimate the average time it took you or your comrades to perform that task in an "average" situation. We understand that there is no real "average" situation, but we must ask that you create one in your head when answering these questions.
(EX: 30s, 40m, 2hr)
% (ACCURACY): Record what the minimum accuracy standard should be required (as percentage correct) when accomplishing the task listed. (EX: 90, 85, 98) Or, what is the expected accuracy for a soldier performing this particular task.
VACP: Refer to the separate sheet which has the scales for the Visual, Auditory, Cognitive, and Psychomotor inputs. Do not be put off if you find that many functions have the same VACP values. This is common. We still need this data from you. To accomplish each listed task, some combination of Visual (looking), Auditory (listening), Cognitive (thinking) and Psychomotor (moving) is required. Some tasks will not require the use of all four components to accomplish.

If this is the case, then put a “0” in the box. (EX: V-4, A-0, C-5, P-2)
Methodology: Look at the critical task (In bold, generally begins with a critical task number, in this example **301-96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL DATA**).
Then review the performance steps associated with each critical task. For each performance step we want you to provide the average length of time you believe it would take a qualified, trained soldier to complete in seconds, minutes or hours. The next column (%) represents the expected accuracy standard for this performance measure. We want your opinion on what accuracy standard is expected on this sub task. What we are asking for is an average accuracy standard required for this task. We are not asking for a performance evaluation on what you think a soldier can/will do, but the required level of accuracy needed to complete this sub task to standard.
The final 4 columns (VACP) represent the estimated workload, in each category, on a soldier doing this sub task. V stand for Visual (seeing, looking), A for Auditory (listening/hearing), C for Cognitive (mental workload / thinking) and P for Psychomotor (non-reflexive muscle movement) Please read the sub task and then refer to the provided VACP scale to determine the appropriate level based on your experience.

Sample from questionnaire

	ERMP Survey						
1	301-96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL DATA	Time	%	V	A	C	P
1.1	Determine the scale of the map sheet in use.	30S	100	4	0	4	2
1.2	Plot given geographic coordinates.	1M	100	5	0	3	1
1.3	Create lines of latitude and longitude by connecting the grid tick marks on the neat lines	2 H	80	6	7	7	7

Note: The times, accuracy % and VACP figures are for example only)

Sample VACP scale

Value	Visual Scale Descriptor - Vision: related to, or used in vision an action done or executed by sight
0	No Visual Activity
1	Visually Register/Detect (detect occurrence of image)
2	Visually Discriminate (detect visual differences)
3	Visually Inspect/Check (discrete inspection/static condition)
4	Visually Locate/Align (selective orientation)
5	Visually Track/Follow (maintain orientation)
6	Visually Read (symbol)
7	Visually Scan/Search/Monitor (continuous/serial inspection, multiple conditions)

Please keep all answers UNCLASSIFIED.

3	301-96D-1101 DETERMINE DIMENSIONS OF AN OBJECT ON IMAGERY	Time	%	V	A	C	P
3.1	Determine the scale of the vertical imagery, if unknown.						
3.2	Identify an object with a known ground distance.						
3.3	Measure the dimensions of the known object.						
3.4	Determine the dimensions of the known object.						
3.5	Convert all measurements into the same units of measurement.						
3.6	Determine the scale of imagery						

4	301-96D-1152 PREPARE A ROUTE OVERLAY	Time	%	V	A	C	P
4.1	ID the routes that are of greatest significance to the CMD						
4.2	Retrieve the appropriate map image or product						
4.3	Determine if the imagery quality is sufficient to accurately analyze the roadway and satisfy the ER.						
4.4	Import the proposed route						
4.5	Locate the route on the imagery.						
4.6	Determine the route classification formula						
4.7	Determine the route width based on the narrowest width of the traveled way.						
4.8	Determine the route type based on its ability to withstand weather.						
4.9	Estimate the military load capacity (MLC) of the route.						
4.10	Analyze any route obstructions/chokepoints by location and type.						
4.11	Analyze any bridges.						
4.12	Determine the geographic positioning data						
4.13	Determine the traveled way width.						
4.14	Analyze any underpasses.						
4.15	Analyze any tunnels.						
4.16	Analyze any sharp curves.						
4.17	Analyze any areas where the roadway is constricted to less than 4 meters by craters, erosion, minefields, or other reasons.						
4.18	Annotate overlay with appropriate classification markings, as required.						
4.19	Determine the appropriate classification marking to be applied.						
4.20	Satisfy the ER.						

9	301-96D-1204 ID ROADWAYS ON IMAGERY	Time	%	V	A	C	P
9.1	Determine the requirement by examining the exploitation requirement(s) (ER).						
9.2	Locate the roadway on the imagery.						
9.3	Determine if the imagery quality is sufficient to accurately ID the roadway.						
9.4	ID the status of the roadway.						
9.5	ID the road classification.						
9.6	ID any route obstructions/chokepoints by location and type.						
9.7	ID any bridges by type.						
9.8	ID any underpasses.						
9.9	ID any tunnels.						
9.10	ID any causeways or fills.						
9.11	ID any sharp curves.						
9.12	ID any areas with slopes/gradients over 7 percent.						
9.13	ID any through or side hill cuts.						
9.14	ID any areas with low overhead clearance under 4.3 meters.						
9.15	ID any areas where the roadway is constricted by craters, erosion, minefields, or other reasons.						
9.16	ID the roadway by functional classification code IAW DIAM 65-3-1.						

18	301-96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY	Time	%	V	A	C	P
18.1	Determine the requirement by examining the exploitation requirement(s) (ER).						
18.2	Obtain any supporting data or references.						
18.3	Maps, charts, or other geospatial intelligence (GEOINT) products						
18.4	Review Target folders						
18.5	Review Historical reports						
18.6	Signatures developed through the analysis of FMV.						
18.7	Obtain imagery and geospatial data.						
18.8	Streaming video downlinked from the aerial vehicle.						
18.9	Conduct analysis and manipulation of data.						
18.10	Conduct analysis of data at various speeds.						
18.11	Conduct analysis of data frame by frame.						
18.12	Perform any audio/video capture.						
18.13	Perform any geographic positioning.						
18.14	Perform any object recognition and identification.						
18.15	Perform any mensuration functions.						
18.16	Perform any manipulation functions (zoom, rotate, overlaying of nonsequential frames, etc.).						
18.17	Perform any change detection.						
18.20	Perform any mosaicing functions.						
18.21	Prepare any SPOT or SALUTE reports.						
18.22	Prepare any imagery derived products (IDP) (301-96D-1159) and reports IAW unit SOP.						

56	CONDUCT AREA RECONNAISSANCE	Time	%	V	A	C	P
56.1	Establish and maintain communications with supported / friendly units						
56.2	Monitor control measures						
56.3	Reconnoiter key and adjacent terrain within the assigned area						
56.4	Locate all obstacles and barriers,						
56.5	Locate a bypass around built-up areas, obstacles, and contaminated areas.						
56.6	Inspect and classify all bridges, overpasses, underpasses, and culverts.						
56.7	Locate fords and crossing sites near all bridges.						
56.8	Locate enemy elements						
56.9	Report the situation based on PIR, IR						

	Additional tasks	Time	%	V	A	C	P
67	ID object, area or activity of interest on an image or video						
68	Provide chip, image or video clip for additional analysis						
69	Provide direction/guidance to UAV sensor operator						
70	respond to request for imagery						
71	Provide direction/guidance to UAV pilot						

Appendix B. Scenario

1

ER/MP UAS Mission Thread/Vignette for IMPRINT Modeling

August 2007

I2SR FDT/E
Capabilities Development Directorate (CDD)
Capabilities Development and Integration (CDI)
USAIC and Ft Huachuca

Scenario
Mission Thread

- Tactical Context: Contemporary Operating Environment

- Case 1: Support to Direct Action
  - Counter-Improvised Explosive Device Operation (C-IED)
    - Detain/Interdict IED HVI (TST)
    - Interdict IED production sites/Weapons Caches
    - IED "Hunting"
  - Blue Task Organization
    - ER/MP AV and Sensor Operator in ER/MP CO of the CAB
    - ER/MP Analysts (w/GCS) attached to Division HQ
    - Mission area inside of a single BCT AO (supported BCT)
    - Division has formed an EOD QRF (Division control)
    - CAB and BCT each have Direct Action QRFs for this operation

Scenario
Intelligence Indicators

- Intelligence Indicators
  - The town has a population of approximately 40K
  - There are 17K+ individual buildings in the town
  - There are 100-250 members in the local guerilla faction
  - The local guerilla faction is composed primarily of former military members
  - This guerilla faction primarily targets Host Nation Security Forces (HNSF) and US Forces
  - There are 15-20 cache sites in the town
  - There is a single IED production site believed to be in the eastern part of the town

4

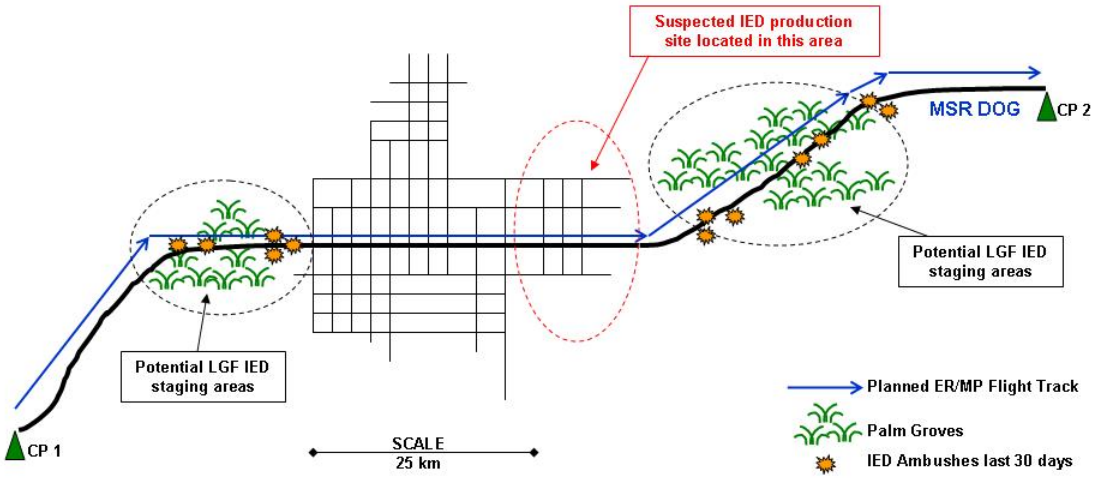
Scenario
Threat TTP

- *Local Guerilla Forces (LGF) IED TTP*
  - *Employ hard wired, command detonated IEDs*
  - *IEDs consist of 2-3 130mm or 152mm artillery shells*
  - *LGF emplaces IEDs in existing road craters and abandoned vehicles along the road side*
  - *On any given day there are 10-20 abandoned vehicles along MSR DOG*
  - *The LGF will emplace 2-4 IEDs on a single night between the hours of 2000 and 0300 local time for employment against HNSF or US forces "targets of opportunity" over the following several days-this pattern repeats itself every 5-8 days*
  - *There are separate LGF groups that move material from the caches to the IED production site…another group will retrieve the partially assembled IEDs and transport them to staging areas in the palm groves outside of town*
  - *The group that emplaces the IEDs must complete final assembly of the IED at the ambush site…this procedure takes 15-30 min*
  - *There are generally 4-6 LGF members providing security while 2 others emplace the IED…one member will stay behind to execute the command detonation*
  - *There is generally one vehicle that transports the partially assembled IEDs to the staging area with 2-3 LGF members*
  - *The 6-8 LGF members that emplace the IEDs will travel in 2-3 vehicles and will rendezvous with the transporters at the staging area where the IEDs will be transloaded*
  - *This pattern will repeat several times through out the night until all the IEDs are emplaced*
  - *The leader of this operation will interact with all of the separate groups*

5

Scenario
Mission

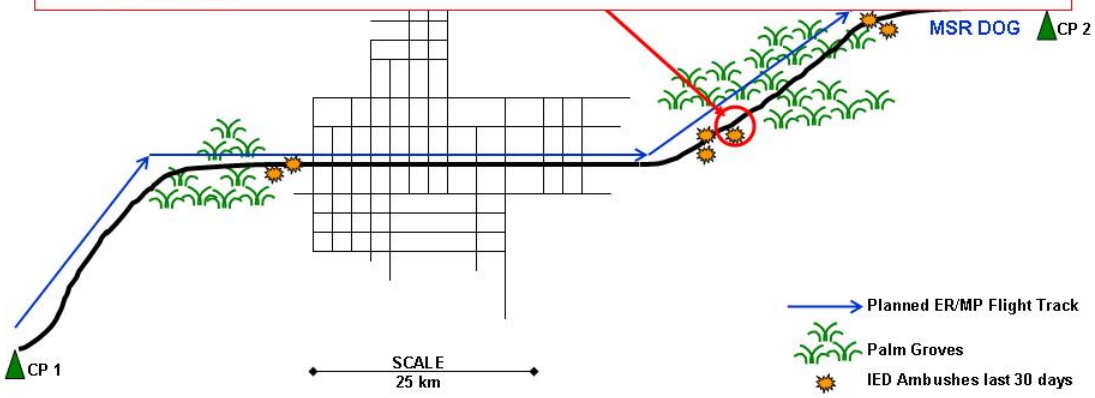
Mission: Conduct Ariel Reconnaissance of MSR DOG between CP 1 and CP 2 to locate and identify potential IED ambush sites, identify and track HVIs and locate and identify IED production sites and weapons caches.



6

Scenario
Mission Execution
IR Sensor, Streaming Video

- *2000 hrs: Mission start time*
- *2000 – 2134 hrs: Multiple reports of suspected threat activity – none confirmed*
- *2134 hrs: ER/MP analysts detect 4 x individuals in the vicinity of an IED ambush site NAI*
  - *Analysts instruct the ER/MP AV operator and sensor operator to maintain sensor contact with the subjects*
  - *Through analysis of a freeze frame image, the analysts determine that the 4 subjects are carrying some type of small arms*
  - *Through analysis of the streaming video, the analysts determine that the 4 subjects are communicating with hand and arm signals*
  - *Analysts produce an IPIR, the supervising analyst directs the team to track the 4 subjects and report their activities*

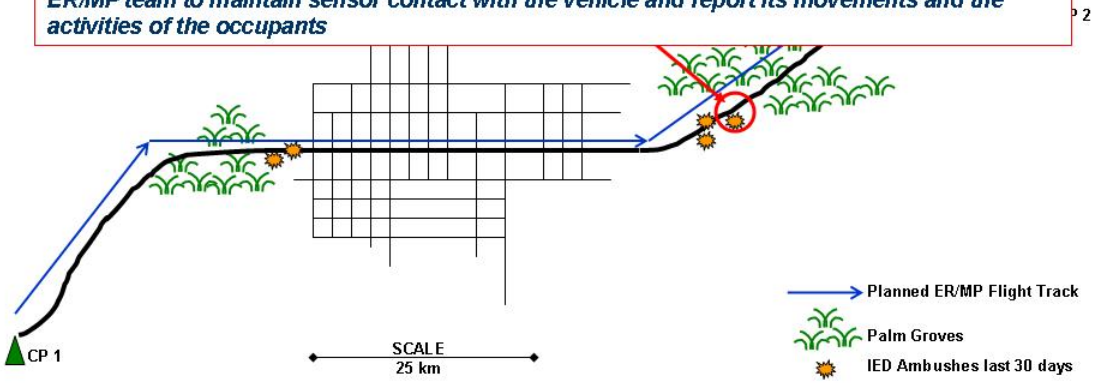


7

Scenario
Mission Execution
IR Sensor, Streaming Video

- *2147 hrs: ER/MP analysts observe an SUV type vehicle pulling up and stopping at the scene*
  - *Analysts observe one of the original subjects approach the vehicle, the subject appears to be holding a conversation with an occupant of the vehicle (Analysts produce an IPIR)*
  - *The supervising analyst instructs the analysts to identify the vehicle (make and model) (phase 2 exploitation?? Done at the Division ACE???)*
  - *Analysts observe a vehicle occupant exit the vehicle and move to the rear of the vehicle with the subject and open the flip top type rear door…the two subjects and the contents of the rear of the vehicle are now out of view due to the sensor look angle…the analysts instruct the AV and sensor operator to reposition the sensor to improve the look angle*

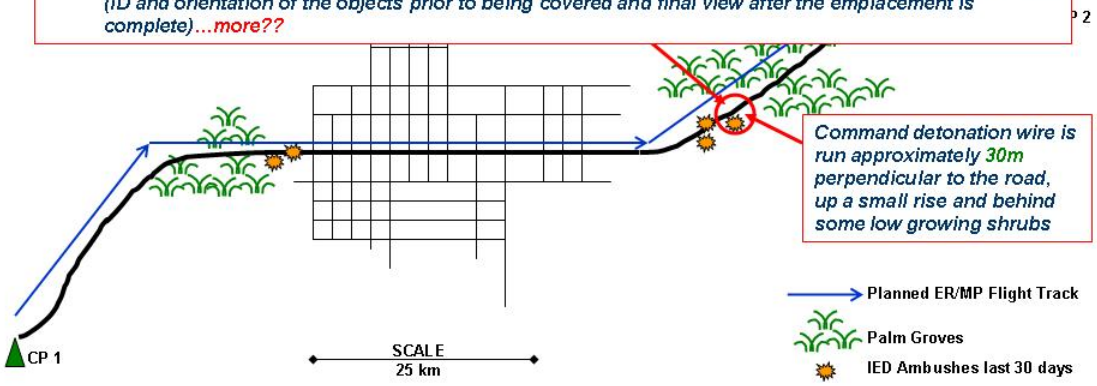
- *2156 hrs: DIV ACE confirms that the vehicle occupants are potential HVIs and directs the ER/MP team to maintain sensor contact with the vehicle and report its movements and the activities of the occupants*



8

Scenario
Mission Execution
IR Sensor, Streaming Video

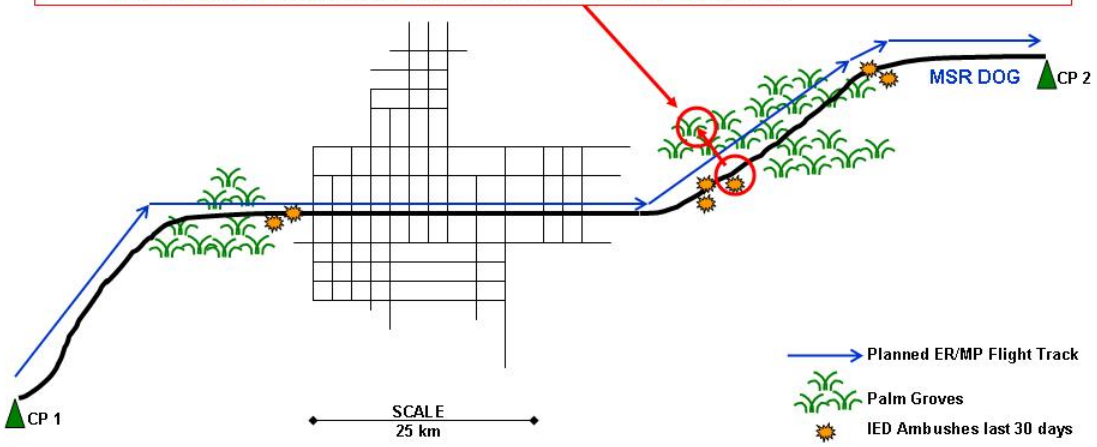
- **2203 hrs: ER/MP analysts observe 2 subjects unloading U/I objects from the back of the vehicle**
  - Through analysis of a freeze frame image, the analysts determine that the objects appear to be some kind of artillery round (long cylindrical objects with one tapered end)
  - The supervising analyst "chips" the image to send to the Division ACE for confirmation and ID
  - The BCT responsible for this AO (the supported BCT) requests several imagery products (IP) of the scene, the vehicle, the disposition of the known subjects, and 3km of MSR DOG to the west of the scene
- **2208 – 2229 hrs: ER/MP analyst observe the emplacement of the suspected IED**
  - The 2 subjects at the vehicle move three of the objects into an existing roadside crater while the other three original subjects appear to be providing security for the activity
  - The Division EOD QRF requests (via the ACE) several IPs annotated to show several aspects of the IED (ID and orientation of the objects prior to being covered and final view after the emplacement is complete)…more??



9

Scenario
Mission Execution
IR Sensor, Streaming Video

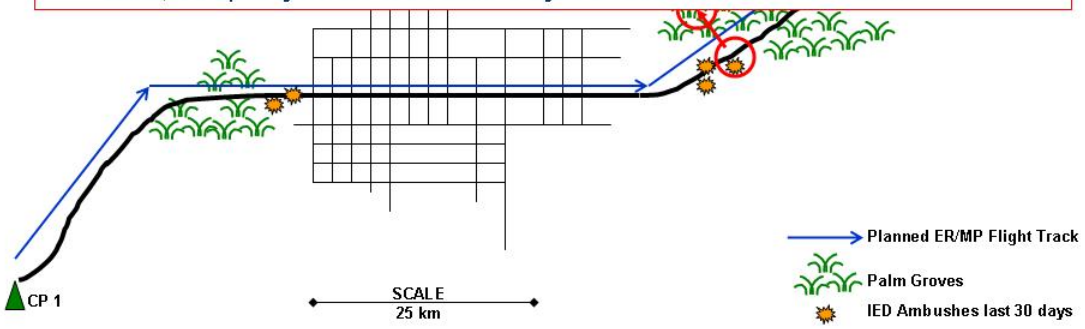
- **2236 hrs: ER/MP analysts observe the vehicle departing the scene**
  - Analysts observe 1 of the original subjects occupy the command detonation position and the other three get into the vehicle with the 5th subject and depart the area
  - As per previous instructions from the Division ACE, the ER/MP analysts ICW the AV operators, maintain sensor contact, and track the vehicle
  - The supervising analyst coordinates with the supported BCT to hand-off surveillance of the IED ambush site to a BCT SHADOW UAS team
  - The vehicle travels approximately 8km NW on an unimproved road through dense palm groves
  - The Division ACE and the supported BCT request multiple IPs of the route



10

Scenario
Mission Execution
IR Sensor, Streaming Video

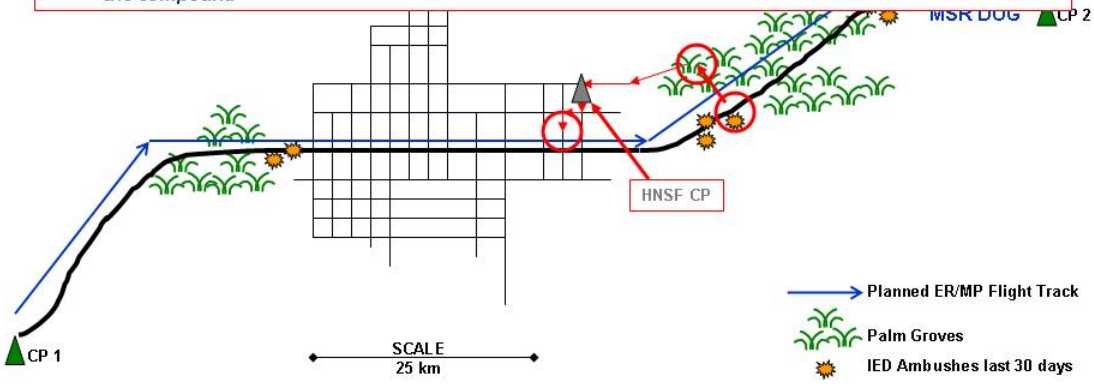
- **2249 hrs: ER/MP analysts observe the vehicle pulling up next to 2 other vehicles**
  - Analysts observe the 4 subjects exit the vehicle and 1 subject each exit the other 2 vehicles
  - The supervising analyst directs the analysts to determine if the 2 new subjects are armed
  - Analysts observe the driver of the original vehicle using what appears to be a small radio
  - The supervising analyst "chips" the image and sends it to the Division ACE for detailed analysis
  - Analysts observe the 3 subjects from the original vehicle begin to transload objects that appear to be 3 more artillery shells from one of the other two vehicles-the supervising analyst "chips" the image to send to the Division ACE for confirmation and ID
  - The supported BCT request several IPs of this activity to include any other potential vehicle ingress/egress routes to this site
- **2257 hrs: In anticipation of these 3 vehicles splitting up and leaving in different directions, the supervising analyst requests further instructions from the Division ACE**
  - The Division ACE determines that the driver of the original vehicle, also observed using the comms device, is the priority HVI directs the ER/MP analysts to maintain sensor contact with him



11

Scenario
Mission Execution
IR Sensor, Streaming Video

- **2319 – 0011 hrs: ER/MP analysts track the HVI and 2 vehicles to a small walled compound**
  - The ER/MP analysts observe the HVI enter 1 of the other 2 vehicles and those 2 vehicles depart the site traveling west on an unimproved road while the 3 original subjects leave the site to the east with the suspected IED material (the Division has directed the Cbt Avn BDE (CAB) ICW the supported BCT to take direct action against the original vehicle and 3 subjects, and the IED ambush site)
  - The ER/MP analysts ICW the AV operators and track the HVI in the trail vehicle as the 2 vehicles travel approximately 42 min, enter the town from the east, make several turns on surface streets (they appear to avoid 3 different HNSF checkpoints and are allowed to rapidly pass through a 4th) and enter a small, walled compound with a house and 2 out buildings
  - While tracking the 2 vehicles, the Division ACE requests multiple IPs of the HNSF checkpoint for detailed analysis and annotated IPs of the vehicle rout, identifying street names and a street address for the compound



Appendix C. IMPRINT Data – Task Flows by Crew Member

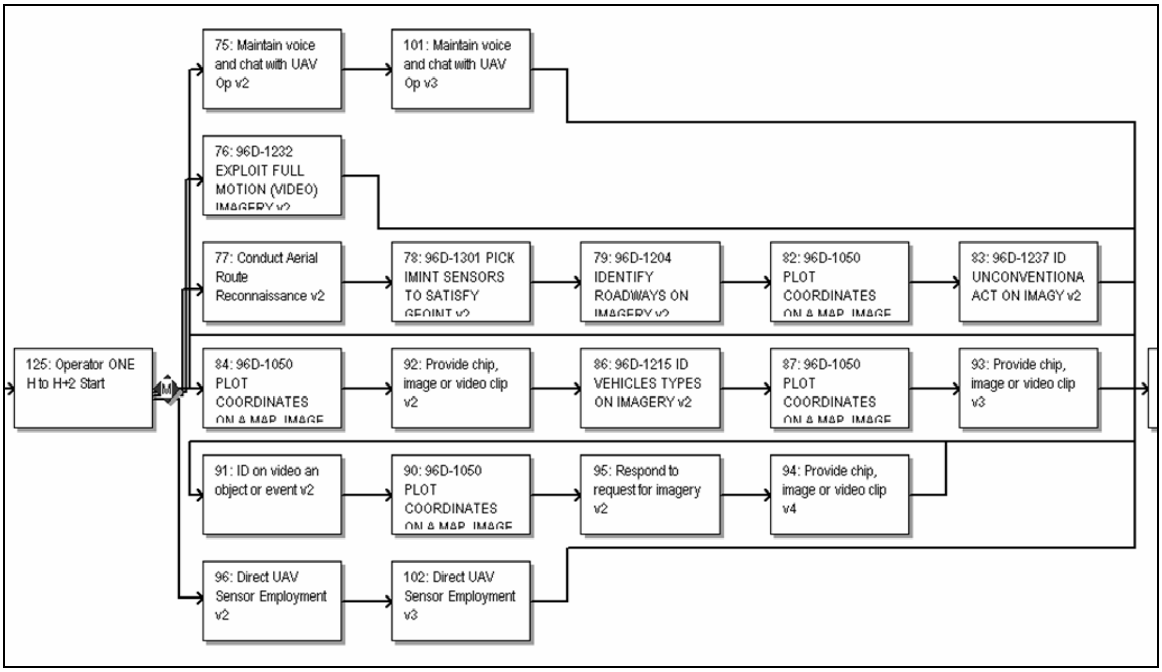


Figure C-1. Crew member 1 – Primary Imagery Analyst.

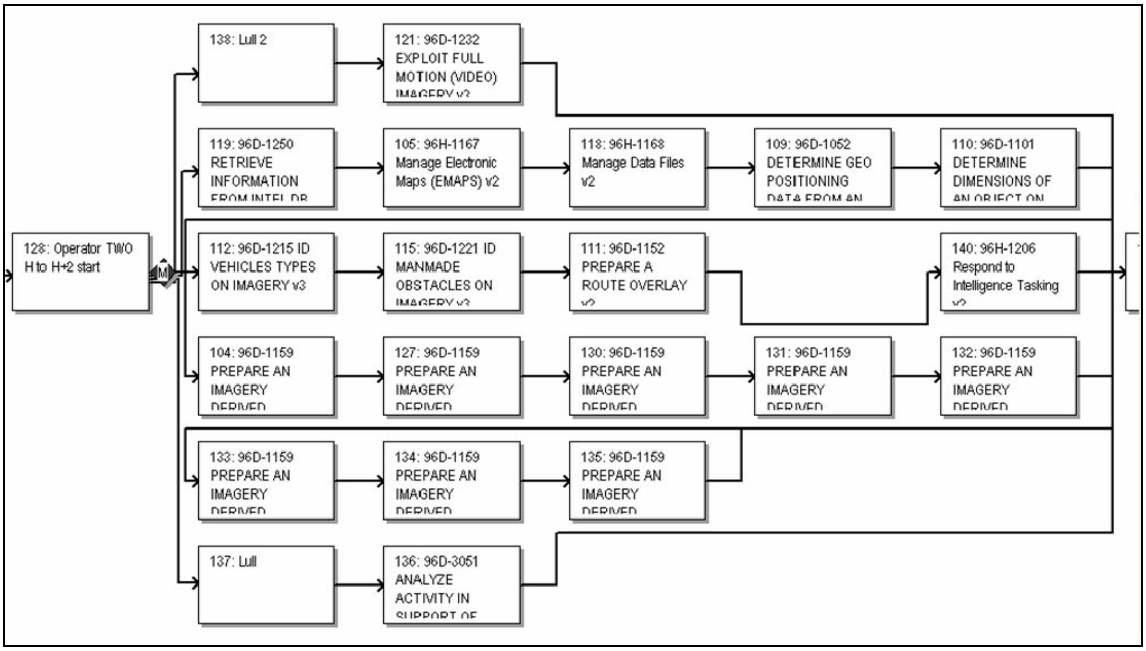


Figure C-2. Crew member 2 – Production Analyst 1.

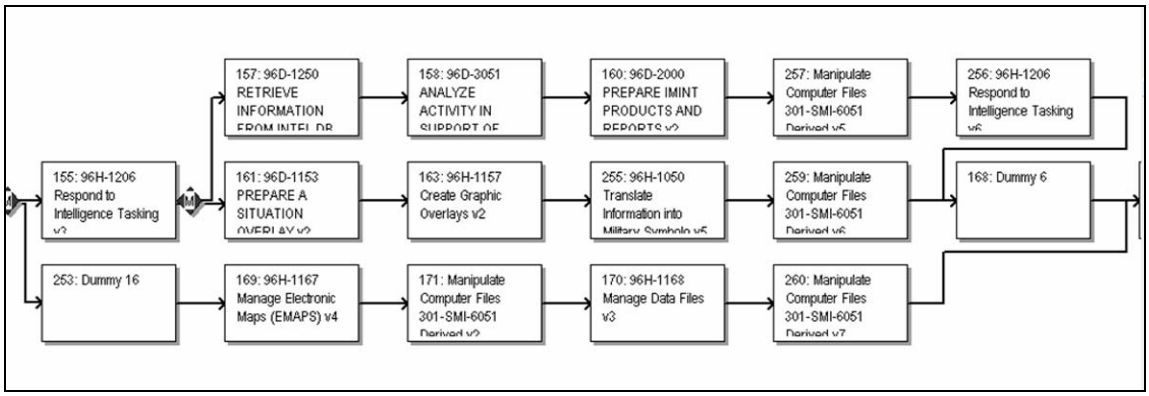


Figure C-3. Crew member 3 – Writer.

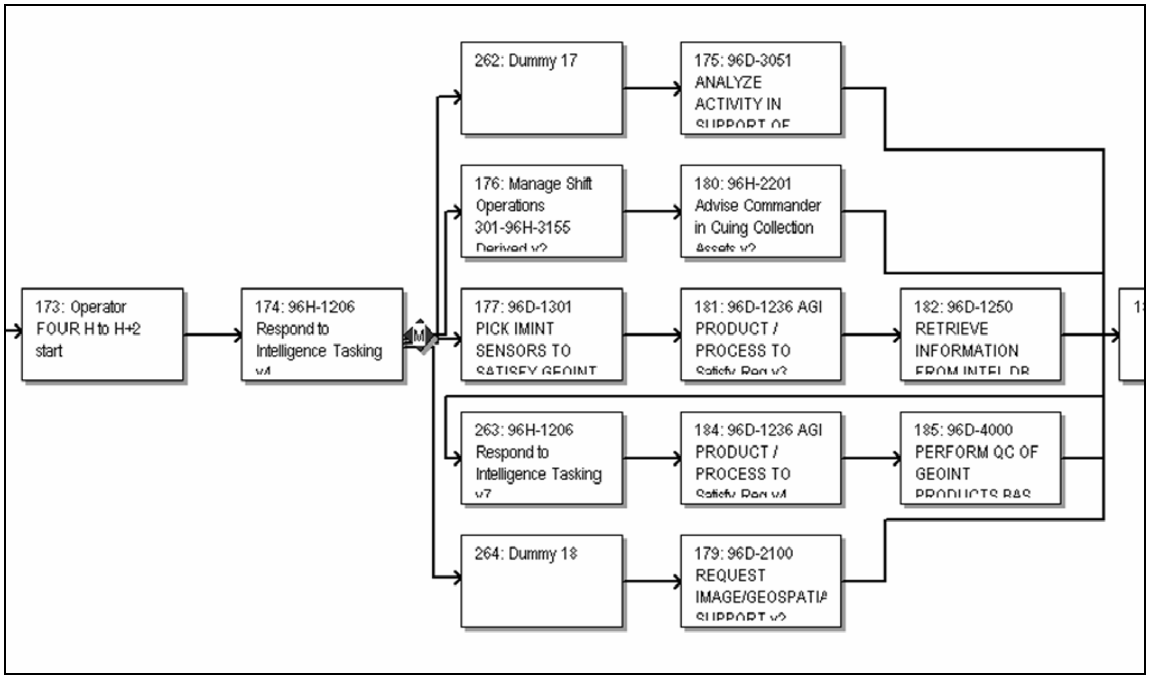


Figure C-4. Crew member 4 – NCOIC.

IMPRINT Operations Model Report
Operator Activity

Run	Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall	Function	Task
1	CrewMember1	00:00:00.00	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v2	Provide direction/guidance to UAV pilot
1	CrewMember1	00:00:00.00	5.90	0.00	5.30	2.60	4	13.80	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Determine the requirement by examining the exploitation requirement(s)
1	CrewMember1	00:00:00.00	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:00:00.00	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:00:29.84	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v2	Provide direction/guidance to UAV pilot
1	CrewMember1	00:00:29.84	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:00:29.84	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:00:29.84	5.90	0.00	4.60	7.00	4	17.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Obtain any supporting data or references.
1	CrewMember1	00:02:12.98	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v2	Provide direction/guidance to UAV pilot
1	CrewMember1	00:02:12.98	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:02:12.98	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:02:12.98	5.90	0.00	5.30	7.00	4	18.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Review Historical reports
1	CrewMember1	00:06:04.78	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:06:04.78	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:06:04.78	5.90	0.00	5.30	7.00	4	18.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Review Historical reports
1	CrewMember1	00:06:04.78	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:08:50.97	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:08:50.97	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:08:50.97	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:08:50.97	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis and manipulation of data
1	CrewMember1	00:14:54.19	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:14:54.19	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:14:54.19	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:14:54.19	5.90	0.00	4.60	7.00	4	17.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Review Target folders
1	CrewMember1	00:16:53.64	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:16:53.64	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:16:53.64	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:16:53.64	5.40	0.00	4.60	6.50	4	16.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Obtain imagery and geospatial data.
1	CrewMember1	00:22:57.06	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor terrain from which the enemy can influence the route
1	CrewMember1	00:22:57.06	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:22:57.06	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:22:57.06	5.40	0.00	4.60	6.50	4	16.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Streaming video downlinked from the aerial vehicle
1	CrewMember1	00:24:00.00	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:24:00.00	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:24:00.00	5.40	0.00	4.60	6.50	4	16.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Streaming video downlinked from the aerial vehicle
1	CrewMember1	00:24:00.00	7.00	0.00	4.60	6.50	4	18.10	Conduct Aerial Route Reconnaissance v2	Monitor control measures
1	CrewMember1	00:25:36.00	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:25:36.00	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:25:36.00	5.40	0.00	4.60	6.50	4	16.50	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Streaming video downlinked from the aerial vehicle
1	CrewMember1	00:25:36.00	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:27:12.81	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:27:12.81	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:27:12.81	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:27:12.81	5.40	0.00	4.60	5.80	4	15.80	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Signatures developed through the analysis of FMV
1	CrewMember1	00:39:32.73	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v2	Break
1	CrewMember1	00:39:32.73	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:39:32.73	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:39:32.73	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data at various speeds.
1	CrewMember1	00:40:27.62	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:40:27.62	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:40:27.62	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data at various speeds.
1	CrewMember1	00:40:27.62	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v2	Provide direction/guidance to UAV sensor operator
1	CrewMember1	00:44:29.41	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:44:29.41	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:44:29.41	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v2	Provide direction/guidance to UAV sensor operator
1	CrewMember1	00:44:29.41	5.90	0.00	5.30	6.50	4	17.70	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data frame by frame
1	CrewMember1	00:45:04.02	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:45:04.02	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID potential ambush, IED locations
1	CrewMember1	00:45:04.02	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v2	Provide direction/guidance to UAV sensor operator
1	CrewMember1	00:45:04.02	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification
1	CrewMember1	00:45:11.51	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:45:11.51	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v2	Provide direction/guidance to UAV sensor operator
1	CrewMember1	00:45:11.51	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification
1	CrewMember1	00:45:11.51	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles

IMPRINT Operations Model Report
Operator Activity (cont'd)

Run	Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall	Function	Task
1	CrewMember1	00:45:12.70	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v2	Break
1	CrewMember1	00:45:12.70	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification
1	CrewMember1	00:45:12.70	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:45:12.70	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:47:07.74	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification
1	CrewMember1	00:47:07.74	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:47:07.74	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:47:07.74	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v3	Provide direction/guidance to UAV pilot
1	CrewMember1	00:47:55.43	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:47:55.43	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:47:55.43	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v3	Provide direction/guidance to UAV pilot
1	CrewMember1	00:47:55.43	5.90	0.00	3.70	6.50	4	16.10	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any geographic positioning.
1	CrewMember1	00:48:44.40	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:48:44.40	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:48:44.40	5.00	4.20	3.70	4.60	4	17.50	Maintain voice and chat with UAV Op v3	Provide direction/guidance to UAV pilot
1	CrewMember1	00:48:44.40	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any mensuration functions
1	CrewMember1	00:51:09.10	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:51:09.10	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:51:09.10	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any mensuration functions
1	CrewMember1	00:51:09.10	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	00:52:35.92	5.90	0.00	4.60	6.50	4	17.00	Conduct Aerial Route Reconnaissance v2	ID other restrictive passages or obstacles
1	CrewMember1	00:52:35.92	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	00:52:35.92	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	00:52:35.92	5.40	0.00	4.60	5.80	4	15.80	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Signitures developed through the analysis of FMV v2
1	CrewMember1	01:01:04.98	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:01:04.98	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:01:04.98	5.40	0.00	4.60	5.80	4	15.80	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Signitures developed through the analysis of FMV v2
1	CrewMember1	01:01:04.98	5.40	0.00	4.60	6.50	4	16.50	Conduct Aerial Route Reconnaissance v2	Maintain comms with supporting / supported and adjacent units
1	CrewMember1	01:02:19.69	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:02:19.69	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:02:19.69	5.40	0.00	4.60	6.50	4	16.50	Conduct Aerial Route Reconnaissance v2	Maintain comms with supporting / supported and adjacent units
1	CrewMember1	01:02:19.69	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data at various speeds v2
1	CrewMember1	01:02:40.98	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:02:40.98	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:02:40.98	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data at various speeds v2
1	CrewMember1	01:02:40.98	5.00	0.00	4.60	2.60	4	12.20	96D-1301 PICK IMINT SENSORS TO SATISFY GEOINT v2	Determine the capabilities and limitations of the imagery sensors
1	CrewMember1	01:07:22.10	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:07:22.10	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:07:22.10	5.00	0.00	4.60	2.60	4	12.20	96D-1301 PICK IMINT SENSORS TO SATISFY GEOINT v2	Determine the capabilities and limitations of the imagery sensors
1	CrewMember1	01:07:22.10	5.90	0.00	5.30	6.50	4	17.70	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Conduct analysis of data fram by frame v2
1	CrewMember1	01:08:30.96	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:08:30.96	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:08:30.96	5.00	0.00	4.60	2.60	4	12.20	96D-1301 PICK IMINT SENSORS TO SATISFY GEOINT v2	Determine the capabilities and limitations of the imagery sensors
1	CrewMember1	01:08:30.96	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v2
1	CrewMember1	01:08:36.03	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:08:36.03	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:08:36.03	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v2
1	CrewMember1	01:08:36.03	5.00	0.00	4.60	2.60	4	12.20	96D-1301 PICK IMINT SENSORS TO SATISFY GEOINT v2	Select the imagery sensor/platform that will satisfy the requirement
1	CrewMember1	01:08:40.33	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:08:40.33	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:08:40.33	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v2
1	CrewMember1	01:08:40.33	5.90	0.00	5.30	4.60	4	15.80	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Determine the requirement by examining the exploitation requirement(s)
1	CrewMember1	01:09:31.21	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:09:31.21	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:09:31.21	5.90	0.00	5.30	4.60	4	15.80	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Determine the requirement by examining the exploitation requirement(s)
1	CrewMember1	01:09:31.21	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object reconition and identification v2
1	CrewMember1	01:10:09.80	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:10:09.80	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:10:09.80	5.90	0.00	5.30	4.60	4	15.80	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Determine the requirement by examining the exploitation requirement(s)
1	CrewMember1	01:10:09.80	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any audio/video capture v2
1	CrewMember1	01:11:25.70	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:11:25.70	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:11:25.70	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any audio/video capture v2
1	CrewMember1	01:11:25.70	5.40	0.00	4.60	5.80	4	15.80	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Locate the roadway on the imagery.

Run	Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall	Function	Task
1	CrewMember1	01:12:15.28	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:12:15.28	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:12:15.28	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any audio/video capture v2
1	CrewMember1	01:12:15.28	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify the status of the roadway.
1	CrewMember1	01:13:01.07	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:13:01.07	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:13:01.07	5.40	0.00	5.30	6.50	4	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any audio/video capture v2
1	CrewMember1	01:13:01.07	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any bridges by type.
1	CrewMember1	01:13:01.64	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:13:01.64	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:13:01.64	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any bridges by type.
1	CrewMember1	01:13:01.64	5.90	0.00	3.70	6.50	4	16.10	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	perform any geographic positioning
1	CrewMember1	01:13:52.81	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:13:52.81	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:13:52.81	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any bridges by type.
1	CrewMember1	01:13:52.81	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any mensuration functions v2
1	CrewMember1	01:15:00.47	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:15:00.47	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:15:00.47	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any mensuration functions v2
1	CrewMember1	01:15:00.47	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any underpasses.
1	CrewMember1	01:18:48.06	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:18:48.06	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:18:48.06	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any underpasses.
1	CrewMember1	01:18:48.06	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions (zoom, rotate, overlay frames
1	CrewMember1	01:19:33.73	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:19:33.73	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:19:33.73	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions (zoom, rotate, overlay frames
1	CrewMember1	01:19:33.73	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any tunnels.
1	CrewMember1	01:20:43.59	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:20:43.59	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:20:43.59	5.40	0.00	5.30	5.80	4	16.50	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any tunnels.
1	CrewMember1	01:20:43.59	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:25:15.84	0.00	0.00	0.00	0.00	4	0.00	Direct UAV Sensor Employment v3	Break
1	CrewMember1	01:25:15.84	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:25:15.84	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:25:15.84	5.90	0.00	5.30	5.80	4	17.00	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any areas where the roadway is constricted
1	CrewMember1	01:27:09.84	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:27:09.84	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:27:09.84	5.90	0.00	5.30	5.80	4	17.00	96D-1204 IDENTIFY ROADWAYS ON IMAGERY v2	Identify any areas where the roadway is constricted
1	CrewMember1	01:27:09.84	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:28:31.01	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:28:31.01	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:28:31.01	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:28:31.01	5.40	0.00	4.60	2.60	4	12.60	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v3	Determine the scale of the map sheet in use v1.
1	CrewMember1	01:28:34.30	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:28:34.30	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:28:34.30	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:28:34.30	5.90	0.00	4.60	5.80	4	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v3	Plot given geographic coordinates.
1	CrewMember1	01:28:57.05	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:28:57.05	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:28:57.05	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:28:57.05	5.90	0.00	4.60	5.80	4	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v3	Create lines of latitude and longitude by connecting the grid tick marks
1	CrewMember1	01:29:17.91	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:29:17.91	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:29:17.91	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:29:17.91	5.40	0.00	5.30	5.80	4	16.50	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v3	Plot any given MGRS coordinates
1	CrewMember1	01:29:40.52	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:29:40.52	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:29:40.52	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:29:40.52	5.40	0.00	3.70	4.60	4	13.70	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v3	Verify the grid zone designator on the map
1	CrewMember1	01:30:20.36	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:30:20.36	5.40	0.00	3.70	5.80	4	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection
1	CrewMember1	01:30:20.36	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:30:20.36	7.00	0.00	6.80	7.00	4	20.80	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Determine the requirement by examining the exploitation requirement

Run	Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall	Function	Task
1	CrewMember1	01:31:35.36	0.00	0.00	0.00	0.00	4	0.00	Maintain voice and chat with UAV Op v3	Break
1	CrewMember1	01:31:35.36	5.40	4.20	5.30	4.60	4	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:31:35.36	7.00	0.00	6.80	7.00	4	20.80	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Determine the requirement by examining the exploitation requirement
1	CrewMember1	01:31:35.36	5.90	0.00	4.60	6.50	4	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports
1	CrewMember1	01:31:46.73	5.40	4.20	5.30	4.60	3	19.50	Direct UAV Sensor Employment v3	Provide direction/guidance to UAV sensor operator
1	CrewMember1	01:31:46.73	7.00	0.00	6.80	7.00	3	20.80	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Determine the requirement by examining the exploitation requirement
1	CrewMember1	01:31:46.73	5.90	0.00	4.60	6.50	3	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports
1	CrewMember1	01:32:26.47	7.00	0.00	6.80	7.00	2	20.80	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Determine the requirement by examining the exploitation requirement
1	CrewMember1	01:32:26.47	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports
1	CrewMember1	01:32:38.07	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports
1	CrewMember1	01:32:38.07	5.40	0.00	4.60	6.50	2	16.50	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Locate the unconventional activity on the imagery / map sheet
1	CrewMember1	01:36:09.50	5.40	0.00	4.60	6.50	2	16.50	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Locate the unconventional activity on the imagery / map sheet
1	CrewMember1	01:36:09.50	5.40	0.00	5.30	6.50	2	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification v3
1	CrewMember1	01:36:21.62	5.40	0.00	5.30	6.50	2	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification v3
1	CrewMember1	01:36:21.62	5.40	0.00	4.60	6.50	2	16.50	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	Determine if the imagery quality is sufficient to ID the activity
1	CrewMember1	01:37:47.47	5.40	0.00	5.30	6.50	2	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any object recognition and identification v3
1	CrewMember1	01:37:47.47	5.90	0.00	3.70	6.50	2	16.10	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	ID the type of unconventional activity
1	CrewMember1	01:38:44.88	5.90	0.00	3.70	6.50	2	16.10	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	ID the type of unconventional activity
1	CrewMember1	01:38:44.88	5.40	0.00	5.30	6.50	2	17.20	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any audio/video capture v3
1	CrewMember1	01:40:43.73	5.90	0.00	3.70	6.50	2	16.10	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	ID the type of unconventional activity
1	CrewMember1	01:40:43.73	5.90	0.00	3.70	6.50	2	16.10	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	perform any geographic positioning v3
1	CrewMember1	01:41:57.63	5.90	0.00	3.70	6.50	2	16.10	96D-1237 ID UNCONVENTIONAL ACT ON IMAGY v2	ID the type of unconventional activity
1	CrewMember1	01:41:57.63	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions v3
1	CrewMember1	01:43:01.19	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions v3
1	CrewMember1	01:43:01.19	5.40	0.00	4.60	2.60	2	12.60	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Determine the scale of the map sheet in use v1.
1	CrewMember1	01:43:06.02	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions v3
1	CrewMember1	01:43:06.02	5.90	0.00	4.60	5.80	2	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Plot given geographic coordinates.
1	CrewMember1	01:43:33.31	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any manipulation functions v3
1	CrewMember1	01:43:33.31	5.90	0.00	4.60	5.80	2	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Create lines of latitude and longitude by connecting the grid tick marks
1	CrewMember1	01:43:41.31	5.90	0.00	4.60	5.80	2	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Create lines of latitude and longitude by connecting the grid tick marks
1	CrewMember1	01:43:41.31	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:43:53.23	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:43:53.23	5.40	0.00	5.30	5.80	2	16.50	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Plot any given MGRS coordinates
1	CrewMember1	01:44:24.70	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:44:24.70	5.40	0.00	3.70	4.60	2	13.70	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v4	Verify the grid zone designator on the map
1	CrewMember1	01:44:55.50	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:44:55.50	5.40	1.00	3.70	4.60	2	14.70	Provide chip, image or video clip v2	Provide chip, image or video clip for additional analysis
1	CrewMember1	01:47:52.78	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:47:52.78	5.90	0.00	5.30	2.60	2	13.80	96D-1215 ID VEHICLES TYPES ON IMAGERY v2	Determine the requirement by examining the exploitation requirement(s)
1	CrewMember1	01:48:50.13	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:48:50.13	5.90	0.00	5.30	5.80	2	17.00	96D-1215 ID VEHICLES TYPES ON IMAGERY v2	Locate the vehicles on the imagery.
1	CrewMember1	01:50:33.41	5.40	0.00	3.70	5.80	2	14.90	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Perform any change detection v3
1	CrewMember1	01:50:33.41	5.90	0.00	5.30	5.80	2	17.00	96D-1215 ID VEHICLES TYPES ON IMAGERY v2	ID any deception attempts to the Vehicles
1	CrewMember1	01:52:15.70	5.90	0.00	5.30	5.80	2	17.00	96D-1215 ID VEHICLES TYPES ON IMAGERY v2	ID any deception attempts to the Vehicles
1	CrewMember1	01:52:15.70	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:52:32.76	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:52:32.76	5.40	0.00	4.60	2.60	2	12.60	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v5	Determine the scale of the map sheet in use v1.
1	CrewMember1	01:52:35.66	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:52:35.66	5.90	0.00	4.60	5.80	2	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v5	Plot given geographic coordinates.
1	CrewMember1	01:53:02.01	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:53:02.01	5.90	0.00	4.60	5.80	2	16.30	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v5	Create lines of latitude and longitude by connecting the grid tick marks
1	CrewMember1	01:53:26.72	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:53:26.72	5.40	0.00	5.30	5.80	2	16.50	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v5	Plot any given MGRS coordinates
1	CrewMember1	01:53:55.13	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:53:55.13	5.40	0.00	3.70	4.60	2	13.70	96D-1050 PLOT COORDINATES ON A MAP, IMAGE OR GEOSPATIAL v5	Verify the grid zone designator on the map
1	CrewMember1	01:54:12.59	5.90	0.00	4.60	6.50	2	17.00	96D-1232 EXPLOIT FULL MOTION (VIDEO) IMAGERY v2	Prepare any SPOT or SALUTE reports v3
1	CrewMember1	01:54:12.59	5.40	1.00	3.70	4.60	2	14.70	Provide chip, image or video clip v3	Provide chip, image or video clip for additional analysis
1	CrewMember1	01:56:37.14	5.40	1.00	3.70	4.60	1	14.70	Provide chip, image or video clip v3	Provide chip, image or video clip for additional analysis
1	CrewMember1	01:57:32.08	5.00	2.00	3.70	4.60	1	15.30	ID on video an object or event v2	ID object, area or activity of interest on an image or video
1	CrewMember1	01:58:43.41	0.00	0.00	0.00	0.00	0	0.00		
1	CrewMember1	01:59:45.69	5.90	2.00	3.70	4.60	1	16.20	Respond to request for imagery v2	Respond to request for imagery
1	CrewMember1	02:03:45.13	5.40	1.00	3.70	4.60	1	14.70	Provide chip, image or video clip v4	Provide chip, image or video clip for additional analysis
1	CrewMember1	02:06:38.72	0.00	0.00	0.00	0.00	0	0.00		

IMPRINT Operations Model Report
Operator Workload

Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall
CrewMember1	00:00:00.00	17.90	4.20	13.60	13.70	4	49.40
CrewMember1	00:00:29.84	17.90	4.20	12.90	18.10	4	53.10
CrewMember1	00:02:12.98	17.90	4.20	13.60	18.10	4	53.80
CrewMember1	00:06:04.78	12.90	0.00	9.90	13.50	4	36.30
CrewMember1	00:08:50.97	12.40	0.00	9.90	13.00	4	35.30
CrewMember1	00:14:54.19	12.90	0.00	9.20	13.50	4	35.60
CrewMember1	00:16:53.64	12.40	0.00	9.20	13.00	4	34.60
CrewMember1	00:22:57.06	12.40	0.00	9.20	13.00	4	34.60
CrewMember1	00:24:00.00	12.40	0.00	9.20	13.00	4	34.60
CrewMember1	00:25:36.00	11.30	0.00	9.20	13.00	4	33.50
CrewMember1	00:27:12.81	11.30	0.00	9.20	12.30	4	32.80
CrewMember1	00:39:32.73	11.80	0.00	9.20	13.00	4	34.00
CrewMember1	00:40:27.62	17.20	4.20	14.50	17.60	4	53.50
CrewMember1	00:44:29.41	17.20	4.20	15.20	17.60	4	54.20
CrewMember1	00:45:04.02	16.70	4.20	15.20	17.60	4	53.70
CrewMember1	00:45:11.51	16.70	4.20	15.20	17.60	4	53.70
CrewMember1	00:45:12.70	11.30	0.00	9.90	13.00	4	34.20
CrewMember1	00:47:07.74	16.30	4.20	13.60	17.60	4	51.70
CrewMember1	00:47:55.43	16.80	4.20	12.00	17.60	4	50.60
CrewMember1	00:48:44.40	16.30	4.20	12.00	16.90	4	49.40
CrewMember1	00:51:09.10	11.30	0.00	8.30	12.30	4	31.90
CrewMember1	00:52:35.92	11.30	0.00	9.20	12.30	4	32.80
CrewMember1	01:01:04.98	10.80	0.00	9.20	12.30	4	32.30
CrewMember1	01:02:19.69	11.30	0.00	9.20	13.00	4	33.50
CrewMember1	01:02:40.98	10.90	0.00	9.20	9.10	4	29.20
CrewMember1	01:07:22.10	10.90	0.00	9.90	9.10	4	29.90
CrewMember1	01:08:30.96	10.90	0.00	9.20	9.10	4	29.20
CrewMember1	01:08:36.03	10.90	0.00	9.20	9.10	4	29.20
CrewMember1	01:08:40.33	11.80	0.00	9.90	11.10	4	32.80
CrewMember1	01:09:31.21	11.30	0.00	10.60	11.10	4	33.00
CrewMember1	01:10:09.80	11.30	0.00	10.60	11.10	4	33.00
CrewMember1	01:11:25.70	10.80	0.00	9.90	12.30	4	33.00
CrewMember1	01:12:15.28	10.80	0.00	10.60	12.30	4	33.70
CrewMember1	01:13:01.07	10.80	0.00	10.60	12.30	4	33.70
CrewMember1	01:13:01.64	11.30	0.00	9.00	12.30	4	32.60
CrewMember1	01:13:52.81	10.80	0.00	9.00	11.60	4	31.40
CrewMember1	01:15:00.47	10.80	0.00	9.00	11.60	4	31.40
CrewMember1	01:18:48.06	10.80	0.00	9.00	11.60	4	31.40
CrewMember1	01:19:33.73	10.80	0.00	9.00	11.60	4	31.40
CrewMember1	01:20:43.59	10.80	0.00	9.00	11.60	4	31.40
CrewMember1	01:25:15.84	11.30	0.00	9.00	11.60	4	31.90
CrewMember1	01:27:09.84	16.70	4.20	14.30	16.20	4	51.40
CrewMember1	01:28:31.01	16.20	4.20	13.60	13.00	4	47.00

IMPRINT Operations Model Report
Operator Workload (cont'd)

Operator	Time	Visual	Auditory	Cognitive	Psychomotor	Number	Overall
CrewMember1	01:28:34.30	16.70	4.20	13.60	16.20	4	50.70
CrewMember1	01:28:57.05	16.70	4.20	13.60	16.20	4	50.70
CrewMember1	01:29:17.91	16.20	4.20	14.30	16.20	4	50.90
CrewMember1	01:29:40.52	16.20	4.20	12.70	15.00	4	48.10
CrewMember1	01:30:20.36	17.80	4.20	15.80	17.40	4	55.20
CrewMember1	01:31:35.36	18.30	4.20	16.70	18.10	4	57.30
CrewMember1	01:31:46.73	18.30	4.20	16.70	18.10	3	57.30
CrewMember1	01:32:26.47	12.90	0.00	11.40	13.50	2	37.80
CrewMember1	01:32:38.07	11.30	0.00	9.20	13.00	2	33.50
CrewMember1	01:36:09.50	10.80	0.00	9.90	13.00	2	33.70
CrewMember1	01:36:21.62	10.80	0.00	9.90	13.00	2	33.70
CrewMember1	01:37:47.47	11.30	0.00	9.00	13.00	2	33.30
CrewMember1	01:38:44.88	11.30	0.00	9.00	13.00	2	33.30
CrewMember1	01:40:43.73	11.80	0.00	7.40	13.00	2	32.20
CrewMember1	01:41:57.63	11.30	0.00	7.40	12.30	2	31.00
CrewMember1	01:43:01.19	10.80	0.00	8.30	8.40	2	27.50
CrewMember1	01:43:06.02	11.30	0.00	8.30	11.60	2	31.20
CrewMember1	01:43:33.31	11.30	0.00	8.30	11.60	2	31.20
CrewMember1	01:43:41.31	11.30	0.00	8.30	11.60	2	31.20
CrewMember1	01:43:53.23	10.80	0.00	9.00	11.60	2	31.40
CrewMember1	01:44:24.70	10.80	0.00	7.40	10.40	2	28.60
CrewMember1	01:44:55.50	10.80	1.00	7.40	10.40	2	29.60
CrewMember1	01:47:52.78	11.30	0.00	9.00	8.40	2	28.70
CrewMember1	01:48:50.13	11.30	0.00	9.00	11.60	2	31.90
CrewMember1	01:50:33.41	11.30	0.00	9.00	11.60	2	31.90
CrewMember1	01:52:15.70	11.80	0.00	9.90	12.30	2	34.00
CrewMember1	01:52:32.76	11.30	0.00	9.20	9.10	2	29.60
CrewMember1	01:52:35.66	11.80	0.00	9.20	12.30	2	33.30
CrewMember1	01:53:02.01	11.80	0.00	9.20	12.30	2	33.30
CrewMember1	01:53:26.72	11.30	0.00	9.90	12.30	2	33.50
CrewMember1	01:53:55.13	11.30	0.00	8.30	11.10	2	30.70
CrewMember1	01:54:12.59	11.30	1.00	8.30	11.10	2	31.70
CrewMember1	01:56:37.14	5.40	1.00	3.70	4.60	1	14.70
CrewMember1	01:57:32.08	5.00	2.00	3.70	4.60	1	15.30
CrewMember1	01:58:43.41	0.00	0.00	0.00	0.00	0	0.00
CrewMember1	01:59:45.69	5.90	2.00	3.70	4.60	1	16.20
CrewMember1	02:03:45.13	5.40	1.00	3.70	4.60	1	14.70
CrewMember1	02:06:38.72	0.00	0.00	0.00	0.00	0	0.00

List of Symbols, Abbreviations, and Acronyms

ANOC	Advanced Non-Commissioned Officers Course
BNOC	Basic Non-Commissioned Officers Course
EO	electro-optical
ERMP	extended range multipurpose
GEOINT	geospatial intelligence
IMINT	imagery, imagery intelligence
IMPRINT	improved performance research integration tool
IR	infrared
MI	military intelligence
MOS	military occupational specialty
MTI	moving target indicator
NGA	National Geospatial-Intelligence Agency
ODIN	observe, detect, identify, neutralize
SAR	synthetic aperture radar
SME	subject matter expert
TF	task force
UAS	unmanned aircraft system (formerly called an unmanned aerial vehicle [UAV])
VACP	visual, auditory, cognitive, and psychomotor

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